What is claimed is:

1. A method for processing sonar information from an underwater hydrophone array, which array has a known spacing between adjacent hydrophones, at frequencies having wavelengths less than two times a spacing between adjacent hydrophones, the method comprising:

a) providing an underwater hydrophone array comprising a plurality of receiver hydrophones, which array has a known length and known spacing between adjacent hydrophones, wherein λ_{DU} is the upper design wavelength for the design upper frequency limit f_{DU} for the array,

b) providing forward motion for the hydrophone array underwater with a vessel at a velocity of the hydrophone array in water V_s;

c) selecting a synthetic upper frequency f_{SU}, wherein the synthetic upper frequency is equal to or greater than the frequency of a signal to be measured;

d) defining a synthetic hydrophone spacing Δd_{SU}, wherein the synthetic hydrophone spacing is equal to $\lambda_{SU}/2$ wherein λ_{SU} is the wavelength for the synthetic upper frequency f_{SU} for the array;

e) determining the time interval for the hydrophones to travel the distance of the synthetic hydrophone spacing,

f) calculating the number of sonar signal wavefronts predicted to be encountered by each hydrophone in the time interval for the hydrophones to travel the distance of the synthetic hydrophone spacing,

g) selecting a telemetry sampling rate for the predicted number of sonar wavefronts, wherein the telemetry sampling rate is selected such that each wavefront is sampled more than once;

h) detecting samples of a first sonar wavefront with each of the hydrophones at a time t_0 and summing and recording the samples at time t_0 with a beamformer to provide a plurality of beam sets at a time t_0;

i) detecting samples of N subsequent sonar wavefronts with each of the hydrophones at $\geq 2N$ equally spaced times in a time interval Δt; summing and recording the samples from each of the hydrophones with a beamformer to provide beam sets for the number of samples taken in the time interval Δt; and

j) combining the beam sets into an assembly of beams at a time $t_1 = t_0 + \Delta t$.

2. The method according to claim 1, wherein step c) comprises selecting a synthetic upper frequency such that the synthetic upper frequency is an integer multiple of the hydrophone array design upper frequency limit f_{DU}.

3. The method according to claim 1, wherein step c) comprises selectively varying the synthetic upper frequency.

4. The method according to claim 1, wherein step f) comprises determining an incident angle of the wavefronts with the array θ, and the speed of sound in water L_s, and determine the number of wavefronts N according to the equation

$$N = \frac{1}{2}[(L_s \cos\theta / V_s) - 1]$$

5. The method according to claim 1, wherein step g) comprises selecting a variable telemetry sampling rate.

6. The method according to claim 1, wherein step g) comprises:
i) calculating a time error between the time when each hydrophone reaches $\lambda_{SU}/2$ for the synthetic hydrophone spacing and the nearest wavefront sampling time; and
ii) applying a correction factor for the time error for correcting a time delay, and moving the resulting combined beam to a position which corrects for the time error.

7. The method according to claim 1 comprising:

a) providing a towed underwater hydrophone array comprising a plurality of receiver hydrophones, which array has a fixed length and a fixed spacing between adjacent hydrophones, each spacing being fixed at a distance equal to $\Delta d_{DU} = \lambda_{DU}/2$ wherein λ_{DU} is the upper design wavelength for the upper design frequency limit f_{DU} for the array, wherein $f_{DU} = Ls/\Delta d_{DU}$ wherein L_s = the speed of sound in the water;

b) towing the array underwater with a vessel at a velocity of the hydrophone array in water V_s;

c) selecting a synthetic upper frequency $f_{SU} = A^* f_{DU}$, wherein A is an integer;

d) defining a synthetic hydrophone spacing $\Delta d_{SU} = \lambda_{SU}/2$ wherein λ_{SU} is the upper synthetic wavelength for the synthetic upper frequency f_{SU} for the array;

e) determining the time interval Δt for the hydrophones to travel the distance Δd_{SU} wherein $\Delta t = \lambda_{SU}/(2*Vs)$;

f) calculating the number of wavefronts N encountered by each hydrophone in time interval Δt by the equation

$$N = ½[(L_s\cos\theta/V_s)-1]$$

wherein θ = the incident angle of the wavefronts with the array.

8. A system for processing sonar information from an underwater hydrophone array, which array has a known spacing between adjacent hydrophones, at frequencies having wavelengths less than two times a spacing between adjacent hydrophones, comprising:

a) an underwater hydrophone array comprising a plurality of receiver hydrophones, which array has a known length and known spacing between adjacent hydrophones, wherein λ_{DU} is the upper design wavelength for the design upper frequency limit f_{DU} for the array,

b) a driver for providing forward motion for the hydrophone array underwater at a velocity of the hydrophone array in water V_s;

c) an arrangement for selecting a synthetic upper frequency f_{SU}, wherein the synthetic upper frequency is equal to or greater than the frequency of a signal to be measured;

d) an instrumentality for defining a synthetic hydrophone spacing Δd_{SU}, wherein the synthetic hydrophone spacing is equal to $\lambda_{SU}/2$ wherein λ_{SU} is the wavelength for the synthetic upper frequency f_{SU} for the array;

e) an implement for determining the time interval for the hydrophones to travel the distance of the synthetic hydrophone spacing,

f) a calculator for calculating the number of sonar signal wavefronts predicted to be encountered by each hydrophone in the time interval for the hydrophones to travel the distance of the synthetic hydrophone spacing,

g) a sampler for selecting a telemetry sampling rate for the predicted number of sonar wavefronts, wherein the telemetry sampling rate is selected such that each wavefront is sampled more than once;

h) a detector for detecting samples of a first sonar wavefront with each of the hydrophones at a time t_0 and summing and recording the samples at time t_0 with a beamformer to provide a plurality of beam sets at a time t_0; and for detecting samples of N subsequent sonar wavefronts with each of the hydrophones at $\geq 2N$ equally spaced times in a time interval Δt; and for summing and recording the samples from each of the hydrophones with a beamformer to provide beam sets for the number of samples taken in the time interval Δt; and

i) a combiner for combining the beam sets into an assembly of beams at a time $t_1 = t_0 + \Delta t$.

9. The system according to claim 8, wherein the arrangement c) comprises a selector for selecting a synthetic upper frequency such that the synthetic upper

frequency is an integer multiple of the hydrophone array design upper frequency limit f_{DU}.

10. The system according to claim 8, wherein the arrangement c) comprises a selector for selectively varying the synthetic upper frequency.

11. The system according to claim 8, wherein the calculator f) comprises a determiner for determining an incident angle of the wavefronts with the array θ, and the speed of sound in water L_s, and determine the number of wavefronts N according to the equation

$$N = \frac{1}{2}[(L_s\cos\theta/V_s)-1].$$

12. The system according to claim 8, wherein sampler is capable of selecting a variable telemetry sampling rate.

13. The system according to claim 8, wherein sampler g) is capable of calculating a time error between the time when each hydrophone reaches $\lambda_{SU}/2$ for the synthetic hydrophone spacing and the nearest wavefront sampling time; and applying a correction factor for the time error for correcting a time delay, and moving the resulting combined beam to a position which corrects for the time error.

14. The system according to claim 8 comprising:

a) an underwater hydrophone array comprising a plurality of receiver hydrophones, which array has a fixed length and an equal fixed spacing between adjacent hydrophones, each spacing being fixed at a distance equal to

$\Delta d_{DU} = \lambda_{DU}/2$ wherein λ_{DU} is the upper design wavelength for the upper design frequency limit f_{DU} for the array, wherein $f_{DU} = Ls/\Delta d_{DU}$ wherein L_s = the speed of sound in the water;

b) a driver for towing the array underwater with a vessel at a velocity of the hydrophone array in water V_s;

c) an arrangement for selecting a synthetic upper frequency $f_{SU} = A^* f_{DU,}$ wherein A is an integer;

d) an instrumentality for defining a synthetic hydrophone spacing $\Delta d_{SU} = \lambda_{SU}/2$ wherein λ_{SU} is the wavelength for the synthetic upper frequency f_{SU} for the array;

e) an implement for determining the time interval Δt for the hydrophones to travel the distance Δd_{SU} wherein $\Delta t = \lambda_{SU}/(2^*Vs)$;

f) a calculator for calculating the number of wavefronts N encountered by each hydrophone in time interval Δt by the equation

$$N = \tfrac{1}{2}[(L_s\cos\theta/V_s)-1]$$

wherein θ = the incident angle of the wavefronts with the array.